Simpson

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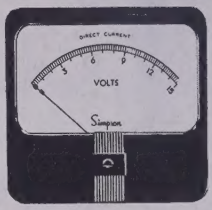
OPERATOR'S MANUAL

A. C. VACUUM TUBE VOLTMETER
MODEL 715

SIMPSON ELECTRIC COMPANY
5200 W. Kinzie St., Chicago 44, Illinois, ES 9-1121
Long Distance Dial 312
In Canada, Bach-Simpson, Ltd., London, Ontario

Simpson panel instruments..



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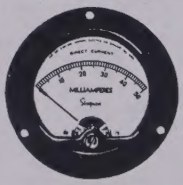
ACCURACY: ±2%
SCALE LENGTH: 1⅞"

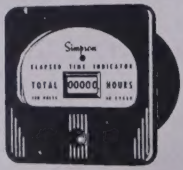
3½" RECTANGULAR
ACCURACY: ±2%
SCALE LENGTH: 2⅜"

2½", 3½", 4½" WIDE VUE
ACCURACY: ±3%



2½" or 3½" ROUND
ACCURACY: ±2%
SCALE LENGTH: 1⅞"

EDGEWISE
ACCURACY: DC ±2%



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Model 650 .....$26.95

DC VTVM
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OPERATOR'S MANUAL

A. C. VACUUM TUBE VOLTMETER
MODEL 715

SIMPSON ELECTRIC COMPANY
5200 W. Kinzie St., Chicago 44, Illinois, ES 9-1121
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In Canada, Bach-Simpson, Ltd., London, Ontario

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FIGURE 1. SIMPSON A.C. VACUUM TUBE VOLTMETER MODEL 715

SECTION I

GENERAL DESCRIPTION

The Simpson A. C. Vacuum Tube Voltmeter Model 715 is a modern, compactly styled test instrument which measures A. C. sine wave voltages from 0.2 millivolt through 300 volts RMS. The frequency response is 10 cycles through 400 kilocycles per second.

High input impedance permits measurements in almost any A. C. circuit without the problems of circuit loading.

The Model 715 meter scale includes a DB arc for applications where readings in terms of decibels are required.

The Model 715 operates on a power input of 110 to 125 volts, 50 or 60 cycles A. C., with 10 watts power consumption.

ACCESSORIES FURNISHED

Each Simpson A. C. Vacuum Tube Voltmeter Model 715 is furnished with an Operator's Manual and a shielded input cable. The banana plugs on the cable connect into the INPUT jacks, and the alligator clips to the circuit being measured.

SPECIFICATIONS

RANGES:

Volts; 0-0.01/0.03/0.1/0.3/1/3/10/30/100/300 RMS

Decibels; total range −52 to +52 DB (0 DB = 1 milliwatt in 600 ohms) Scale markings −12 to +2 DB

General Description

ACCURACY:

±5% of full scale

FREQUENCY RESPONSE:

.01 Volt to 100 Volt ranges: 10 cps to 400 KC, ±1 db
300 Volt range: 10 cps tp 40 KC, ±2 db

TESTER SENSITIVITY:

10 millivolts full scale (lowest range)

INPUT IMPEDANCE: (measured at the binding posts)

.01 Volt through 3 Volt ranges: 15 megohms resistance shunted by 33 picafarads.

All ranges above 3 Volts: 1 megohm resistance shunted by 35 picafarads.

INTERNAL MULTIPLIERS:

±1% precision resistors

METER MOVEMENT:

Simpson 4-inch Wide-Vue meter, 200 microampere movement

TUBE COMPLEMENT:

One type 6C4, two type 12AT7

POWER SUPPLY:

Power transformer with selenium rectifier

INPUT POWER REQUIREMENTS:

110 to 125 volts, 50 or 60 cycles, 10 watts

CASE DIMENSIONS:
7½ inches wide by 5½ inches high by 3 inches deep

WEIGHT:
3 pounds, 12 ounces

FUNCTION SWITCH

The function switch on the front panel selects the range for the tester and controls its power. When it is set at any of the ten range positions, the switch turns on power for the tester and selects the desired voltage range (F.S.). Power is off when the switch is set at either of its two OFF positions.

SCALE MARKINGS

Two meter arcs are provided for reading voltages; one arc is divided for 0 to 3 units, and the other for 0 to 10 units. The correct reading is obtained by simple decimal point placement, according to the range used.

Each range position is also marked for a decibel value. The decibel reading shows a power level, and the reference level is 1 milliwatt in 600 ohms for 0 DB.

INPUT CONNECTORS

The INPUT connectors at the lower right side of the front panel accept the banana plugs on the input cable which is furnished with the unit. Although polarity is not important in reading A. C. voltages, the black connector at the left should be used for the lead which connects to chassis-ground in any circuit being measured.

SECTION II

OPERATING INSTRUCTIONS

ZERO ADJUSTMENT

With no power connected to the Model 715, and with the test leads disconnected, check to see that the indicating meter reads zero when the tester is set in its operating position. If it does not, slowly turn the meter-adjust screw in either direction until the pointer rests over the 0 mark on the voltage arcs; then back the screw off slightly to release pressure from the adjusting fork. The meter-adjust screw is located on the front of the meter just below the center of the dial.

MEASURING A. C. VOLTAGES

WARNING

As a protection to the operator, it is suggested that power be turned off in the circuit being measured whenever connecting or disconnecting the test leads.

1. Connect the power cord into a source of 110 to 125 volts, 50 or 60 cycles, A. C. power.
2. Set the switch of the Model 715 in the 300 v position.
3. Allow two or three minutes of warm-up time before using the instrument.
4. Connect the test lead from the black INPUT connector of the Model 715 to the chassis of the circuit to be measured.

CAUTION

The case of the Model 715 is connected to the black (common) input connector.

5. Connect the other test lead to the other side of the circuit to be measured.
6. Set the function switch for the desired range. When the voltage to be measured is not known, set the function switch for a high range first; the range may be set lower after meter indications show it to be within a lower range.
7. Read the meter indication on the Model 715.

MEASURING DECIBELS

The decibel unit is an indication of a power ratio. As long as comparisons are made between measurements across identical impedances, decibels may also be an indication of voltage ratios. In the Model 715 measurements, decibel indications assume that the circuit in which each measurement is made has 600 ohms impedance. When this is true, each DB reading shows a relation to 0.7746 volt for 0 DB (1 milliwatt in 600 ohms). When a reading is "–", its level is below 0.7746 volt; when the reading is "+", its level is above 0.7746 volt.

For example:

A voltage measurement of 0.7746 volt is the same as 0 DB.

A voltage measurement of 0.3873 volt is the same as –6 DB.

Operating Instructions

A voltage measurement of 7.746 volts is the same as +20 DB.

When two levels are to be compared with each other, it is not necessary that their impedance be 600 ohms, but rather that the same impedance be present in each of the two circuits. The algebraic difference between the two DB readings will be the correct difference between the two levels.

For example:

Suppose the relative levels in two circuits are to be compared and the circuit impedance is 500 ohms in both circuits. The Model 715 shows +3 DB for one of the circuits, and −2.5 DB for the other circuit. The algebraic difference between the two readings is 5.5 DB;

$$[(+3\text{ DB}) - (-2.5\text{ DB})] = 5.5\text{ DB}$$

the circuit with the higher reading is at a level which is 5.5 DB above the level in the other circuit, or, the circuit with the lower reading is 5.5 DB below the other circuit. Neither of these readings is correct for 0 DB equal to 1 milliwatt in 600 ohms, but the algebraic difference between the readings is correct.

Proceed as follows for measuring DB:

1. Repeat steps 1 through 7 of the instructions for Measuring A. C. Voltages.
2. Turn on power in the circuit to be measured. Read the meter indication on the DB arc of the Model 715. Add algebraically the amount shown at the switch position being used for the measurement.

For example:

Suppose the meter reads −5 DB when the switch is set at the 0−.01 volt range; this position is also marked −40 DB. Add algebraically −5 and −40 for the level indication of −45 DB.

3. Turn power off for the circuit being measured, and then move or disconnect the test lead connections.

RESIDUAL READINGS

With the input terminals of the Model 715 shorted together, a residual meter reading of approximately 0.4 millivolts will exist. This is inherent in this class of instrument, and does not affect the accuracy of reading above this residual level.

MEASUREMENT PRECAUTIONS

To avoid excessive residual readings, the following measurement precautions must be observed. This is particularly important when measuring the output of low level voltage sources of high internal impedance.

1. With the input terminals of the Model 715 open and the range switch in the 1 Volt position, orient the line cord plug for a minimum residual reading.

2. Connect the Model 715 Case or the black input terminal marked ground (⏚) to a suitable earth (power line) ground. In some instances, it may be necessary to connect the ground of the circuit being measured to this same ground.

CAUTION

When making measurements on line powered circuits, check the circuit ground to be sure it is isolated from the line ground. If it is not, orient the circuit ground such that the circuit ground is at the same potential as line ground.

When these precautions are followed, the output of voltage sources with internal impedances of up to 1 megohm can be measured on the .01 through 1 Volt ranges of the Model 715 with full accuracy.

On all higher voltage ranges, the residual effect is minimized and voltage sources with higher internal impedances can be measured. At these higher impedances, however, the loading effect of the Model 715, i.e., its internal impedance, must be considered.

SECTION III

THEORY OF OPERATION

INPUT CIRCUIT

For the lower ranges, 0–0.01 through 0–3 Volts, the voltage to be measured is coupled through a capacitor to the grid of tube V1, a type 6C4 cathode follower, and from its cathode through another capacitor to a voltage divider network. For the higher ranges, 0-10 through 0-300 Volts, the voltage is coupled through a capacitor directly into a high-impedance voltage divider. Either of these input circuits offers a very high impedance across the input jacks to any voltage which is to be measured.

The function switch, acting as a range selector, connects a proportional part of the input voltage to the grid of a cascode amplifier, V2. This amplifier is characterized by high gain with low noise.

Amplified voltage is applied to a full wave bridge rectifier, which furnishes the D. C. potential to operate the meter. Resulting meter pointer deflection is proportional to, and indicative of, the input A. C. voltage. All readings assume that the input is a pure sine wave, and indications are for RMS values.

The cascode amplifier circuit incorporates negative feedback for stability. Calibration of the tester is accomplished by varying the feedback in the amplifier to control its gain.

SECTION IV

MAINTENANCE

CASE REMOVAL

To remove the tester from its case, remove the two screws located on the rear of the case. All components are attached to the front panel and will be removed with it.

CALIBRATION

Potentiometer P1, located on the bridge rectifier terminal board inside the case, is the calibration adjustment. If calibration is required, obtain a voltage measuring standard and a 1 KC/sec. voltage source; connect the Model 715 and the voltage measuring standard across the voltage source. For optimum accuracy, set the voltage source to 10 volts, as indicated on the voltage measuring standard. Set the Model 715 function switch for the 10 volt range. Adjust P1 until the Model 715 indication is the same as that of the standard. Do not attempt any adjustment of this potentiometer unless the proper equipment is available and the foregoing instructions are followed.

REPLACEMENT OF PARTS

All of the components in the Model 715 have been engineered for many years of useful life. However, there are conditions under which parts may become damaged or faulty, and require replacement. Refer to the list of Simpson Warranty Repair Sta-

tions and Parts Depots at the rear of the manual, and either return the Model 715 to the nearest Repair Station for the necessary repair, or send to the nearest Parts Depot for any required parts; use the Simpson Part number and the complete part description for each item to assure proper replacement parts.

PARTS LIST

Circuit Symbol	Description	Simpson Part No.
C1	Capacitor, 0.047 μf ±10%, 600 v	1-118406
C2	Capacitor, 0.033 μf ±10%, 600 v	1-118623
C3	Capacitor, 20 μf, −10%, +100%, 150 v	1-114105
C4	Capacitor, 20-20 μf, −10%, +100%, 150 v	1-118404
C5	Capacitor, 2200 μμf, ±10%, 600 v	1-116557
C6	Capacitor, 10 μf, −10%, +100%, 50 v	1-115506
C7	Capacitor, 100 μf, −10%, +100%, 50 v	1-118407
C8	Capacitor, 0.01 μf, ±10%, 500 v	1-114872
C9	Capacitor, 2 μf, ±10%, 200 v	1-118405
C10	Capacitor, 220 μμf, ±10%, 500 v	1-113854
D1	Rectifier, selenium, 65 ma	1-118403
D2	Diode, Germanium, IN295	1-117645
P1	Potentiometer, 10 ohms ±10%, wire wound	1-118386
R1	Resistor, 2.2 megohms ±10%, ½ w	1-114683
R2	Resistor, 2.2K ±10%, ½ w	1-113941
R3	Resistor, 47K ±10%, ½ w	1-114881
R4	Resistor, 21,620 ohms ±1%, ½ w	1-118394
R5	Resistor, 6838 ohms, ±1%, ½ w	1-118395
R6	Resistor, 2162 ohms, ±1%, ½ w	1-118396
R7	Resistor, 683.8 ohms, ±1%, ½ w	1-118390
R8	Resistor, 216.2 ohms, ±1%, ½ w	1-118391

R9	Resistor, 100 ohms, ±1%, ½ w	1-118397
R10	Resistor, 1.1 meg, ±1%, ½ w	1-118389
R11	Resistor, 683.8 ohms, ±1%, ½ w	1-118390
R12	Resistor, 216.2 ohms, ±1%, ½ w	1-118391
R13	Resistor, 68.38 ohms, ±1%, ½ w	1-118392
R14	Resistor, 31.62 ohms, ±1%, ½ w	1-118393
R15	Resistor, 10K, ±10%, 1 w	1-114554
R16	Resistor, 47 ohms, ±10%, ½ w	1-113921
R17	Resistor, 47 ohms, ±10%, ½ w	1-113921
R18	Resistor, 100K, ±10%, ½ w	1-113949
R19	Resistor, 220K, ±10%, ½ w	1-114226
R20	Resistor, 2.2 megohms, ±10%, ½ w	1-114683
R21	Resistor, 680 ohms, ±10%, ½ w	1-118399
R22	Resistor, 30 ohms, ±10%, ½ w	1-118402
R23	Resistor, 47K, ±10%, ½ w	1-114881
R24	Resistor, 470 ohms, ±10%, ½ w	1-113940
R25	Resistor, 150K, ±10%, ½ w	1-113677
R26	Resistor, 3.3 megohms, ±10%, ½ w	1-114348
R27	Resistor, 1K, ±10%, ½ w	1-111689
S1	Switch, Function	1-118353
T1	Transformer, power	1-118387
V1	Tube, type 6C4	1-113975
V2	Tube, type 12AT7	1-115466
V3	Tube, type 12AT7	1-115466
	Knob, Function switch	1-115548
	Cable Assembly, Input	10-860100
	Replacement Meter	15-AC2715
	Lamp, Panel, 6 v bayonet	1-113747

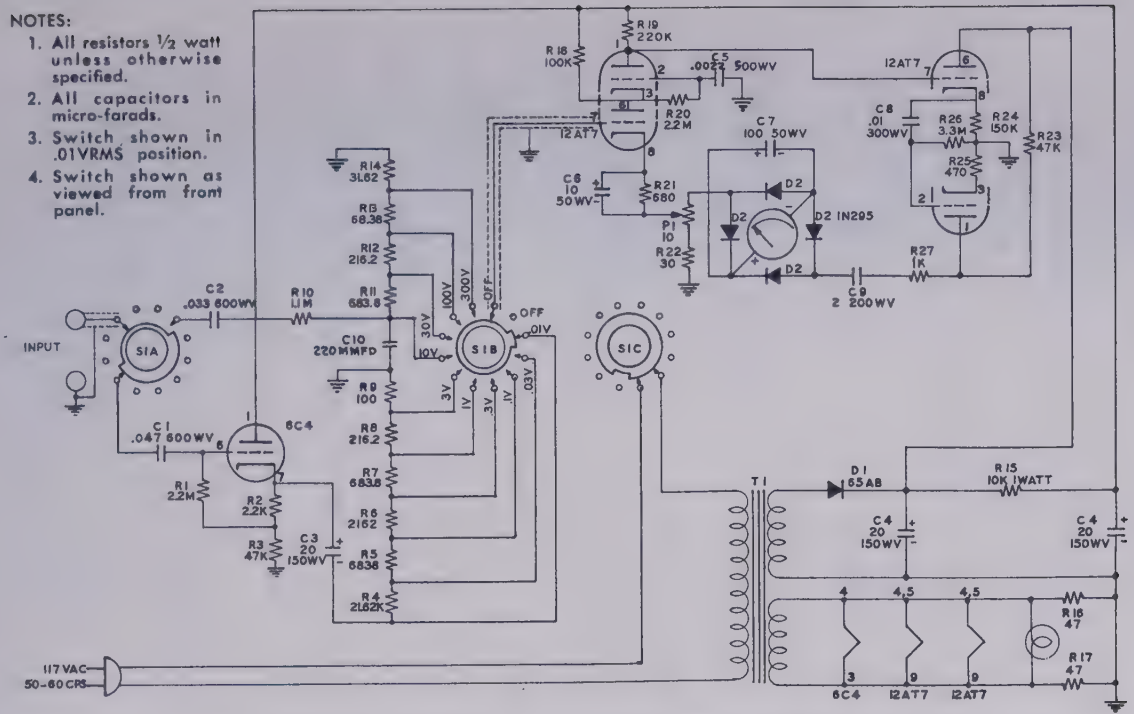

FIGURE 2. SIMPSON A.C. VACUUM TUBE VOLTMETER MODEL 715, SCHEMATIC DIAGRAM

SIMPSON WARRANTY REPAIR STATIONS AND PARTS DEPOTS

**ARIZONA, PHOENIX
Metercraft, Inc., 3304 N. 24th Street
States: Arizona
Phone: Area Code 602, CRestwood 9–5287

CALIFORNIA, LOS ANGELES
Quality Electric Company, 3700 South Broadway
States: So. California below Fresno and Arizona
Phone: Area Code 213, ADams 2–4201

CALIFORNIA, SAN FRANCISCO
Pacific Electrical Instrument Lab, 111 Main Street
States: No. California above Fresno and Nevada
Phone: Area Code 415, GArfield 1–7185

**CANADA, LONDON, ONTARIO
Bach-Simpson Ltd., 1255 Brydges Street, P.O. Box 484
Phone: Area Code 519, GLadstone 1–9490

COLORADO, DENVER
Meter-Master Instrument Service, 2379 S. Downing St.
States: Wyoming, Utah, Colorado, and New Mexico
Phone: Area Code 303, RAce 2–8670

CONNECTICUT, NEW HAVEN
Kaufman Instrument Labs, Inc., 810 Dixwell Avenue
States: Connecticut
Phone: Area Code 203, SPruce 6–7201

FLORIDA, ORLANDO
Electro Tech, Inc., Florida Division, 307 - 27th Street
States: Florida
Phone: Area Code 305, GArden 3–5589

*Parts Depots only; no repairs.
**Repair Stations only; no resale of parts.
All others repair instruments and sell repair parts.

GEORGIA, ATLANTA
Electro-Tech, Inc., 690 Murphy Ave., S.W.
States: Alabama, Georgia, N. & S. Carolina, Tennessee
Phone: Area Code 404, PLaza 3–4128

**ILLINOIS, CHICAGO
Simpson Electric Company, 5200 W. Kinzie Street
Phone: Area Code 312, FStebrook 9–1121

*ILLINOIS, CHICAGO
Pacific Indicator Company, 5217 W. Madison Street
States: Chicago, Wisconsin and Indiana

**KANSAS, SHAWNEE MISSION
Sturtz Instrument Co., 4705 Mission Road
States: Kansas
Phone: Area Code 913, STarline 1–4711

LOUISIANA, NEW ORLEANS
Industrial Instrument Works, 3328 Magazine St.
States: Arkansas, Mississippi, and Louisiana
Phone: Area Code 504, TWinbrook 5–5621

MASSACHUSETTS, CAMBRIDGE
Alvin C. Mancib Company, 363 Walden Street
States: Vermont, New Hampshire, Massachusetts,
Rhode Island, and Maine
Phone: Area Code 617, UNiversity 4–2494

MICHIGAN, DETROIT
Ram Meter, Inc., 1100 Hilton Road, Ferndale
States: Michigan
Phone: Area Code 313, LIncoln 7–1000

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MINNESOTA, MINNEAPOLIS
Instrumentation Services, 917 Plymouth Avenue
States: Minnesota, North and South Dakota
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MISSOURI, ST. LOUIS
Scherrer Instruments, 5449 Delmar Blvd.
States: Illinois below Peoria, Iowa, Missouri
Phone: Area Code 314, FOrest 7–9800

NEW JERSEY, RIVERDALE
A & M Instrument Service, Inc, 11 Hamburg Turnpike
States: New Jersey
Phone: Area Code 609, MArket 4–7757

NEW YORK, BUFFALO
Electrical Instrument Labs., 932 Hertel Avenue
States: New York State except Met. New York
Phone: Area Code 716, EXport 2–2726

NEW YORK, GREAT NECK, LONG ISLAND
Simpson Instrument Service Corp., 130 Cutter Mill Rd.
States: Metropolitan New York
Phones: Area Code 212, MUrray Hill 3–0674,
HUnter 2–3103

NEW YORK, LONG ISLAND CITY
A & M Instrument Service, Inc., 48-01 31st Street
States: Metropolitan New York
Phone: Area Code 212, RAvenswood 6–4343

**NEW YORK, SYRACUSE
Syracuse Instrument Lab, 4895 South Ave., Box 96
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OHIO, CLEVELAND
Weschler Electric Company, 4250 W. 130th Street
States: Ohio and Kentucky
Phone: Area Code 216, CLearwater 1–4609

**OKLAHOMA, TULSA
Tri-State Instrument Lab., 3244 East 15th Street
States: Oklahoma
Phone: Area Code 918, WE 6–0489

**OREGON, PORTLAND
The Instrument Laboratory, 1910 N. Killingsworth St.
States: Oregon
Phone: Area Code 503, BElmont 4–6683

PENNSYLVANIA, PHILADELPHIA
Sunshine Scientific Instrument, 1810 Grant Avenue
States: Pennsylvania, Maryland, Delaware, and
New Jersey below Trenton
Phone: Area Code 215, ORchard 3–5600

†TEXAS, DALLAS
Ultra Instrument Laboratories, 3515 Swiss Ave.,
Suite 117
Phone: Area Code 214, TAylor 6–6395

VIRGINIA, FALLS CHURCH
United Instrument Lab., Inc., 110 Jefferson St.
States: Virginia, West Virginia, Washington, D.C.
Phone: Area Code 703, JEfferson 2–1212

WASHINGTON, SEATTLE
The Instrument Lab, Inc., 934 Elliott Avenue West
States: Oregon, Washington, Idaho, and Montana
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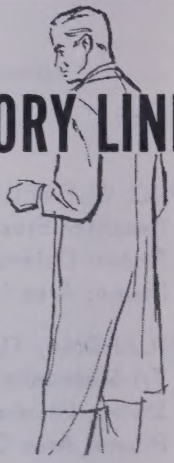
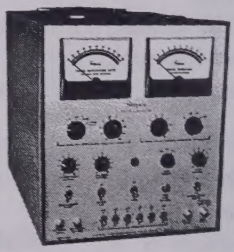


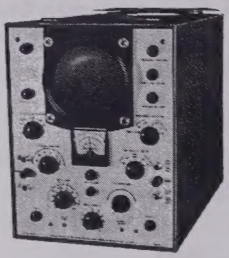


PULSE GENERATOR . . . model 2620

No Unit Offers Such Accuracy, Versatility, and Set-Up Speed Within This Price Range

Twin meters read pulse repetition frequency and pulse duration simultaneously. Rise time is 0.02 microseconds; decay time, 0.03 microseconds. Pulse duration, continuously variable from 0.1 to 1000 microseconds. Jitter, less than 0.005 microseconds. Pulse repetition rate, continuously variable from 10 to 100,000 pps in four ranges. Price **$625**

WRITE FOR COMPLETE SPECIFICATIONS



WIDE-BAND OSCILLOSCOPE . . . model 2610

For the 1001 Jobs Where You Don't Need an Expensive Specialized Scope

Here's a high-gain scope that makes your test equipment appropriation go farther. Vertical sensitivity, 6 mv RMS. Vertical calibration accuracy, ± 3%. Response (linear position): DC to 5.0 mc/sec. ± 0.5 db; DC to 8.0 mc/sec, ± 1.5 db. Response (transient position): DC to 3.5 mc/sec.–3 db, and –6 db at 5.0 mc/sec. Triggered and recurrent sweeps. Precalibrated sweep positions of 5, 50, 500, 5000 microseconds. Price **$575**

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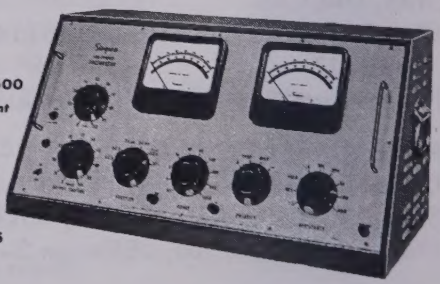
LABORATORY STANDARD
VOLT-OHM-MILLIAMMETER . . . model 2600

A Self-Powered Calibrator for Electrical Instrument Maintenance and High Accuracy Testing

Two terminal connections cover all 49 ranges for unusually fast operation. DC accuracy is ± 0.5% F.S.; AC, ± 0.75% F.S. (at 77°F, 25°C). Separate meters (*self shielded* movements) for DC and AC readings. Price **$1620**

WRITE FOR COMPLETE SPECIFICATIONS



WARRANTY

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

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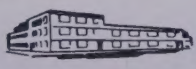
LAKE STREET PLANT
CHICAGO



KINZIE STREET PLANT
CHICAGO

AURORA PLANT
AURORA, ILL.

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